

Crafting Sound and Space

Working with Ambisonics using blue and Csound

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Overview

- Brief Overview of Ambisonics
- Analyze requirements for working with Ambisonics for composition
- Discuss different strategies of working with blue and Csound to compose using Ambisonics

Ambisonics – Characteristics

- Supports Periphony
- The image is fairly stable and precise, independent from the position of the virtual sound in regard to the speaker
- The position of the listener is not that important for getting a fairly good impression of localisation
- It can be combined with the distance-clues of the virtual sound source
- Once encoded it can be decoded for performance to any desired speaker-setup in a versatile way, as long as it is symmetric
- Ambisonics is free and efficient

Ambisonics - Encoding/Decoding

- Encoding stores the position of the maximum of the sound energy in files which relate to different directions in space. Thus both, the energy and the velocity of a particle of air affected by a sound wave can be stored
- Once encoded, the encoded signal can be decoded to different speaker setups

Ambisonics Encoding/Decoding

- The higher the order of encoding, the higher is the accuracy with which the spatial information is stored.
- The higher the number of speakers for decoding, the higher is the accuracy with which the stored spatial information is reproduced.

Ambisonics – Encoding Orders

- Introduction to the Furse-Malham Set of Equations:
- First Order Ambisonic: Encoding into 4 audio files (W, X, Y, Z)
- Second Order Ambisonic: Encoding into 9 audio files (W, X, Y, Z, R, S, T, U, V)
- Third Order Ambisonic: Encoding into 16 audio files (W, X, Y, Z, R, S, T, U, V, L, M, N, O, P, Q)
- Fourth Order Ambisonic: ...
- The higher the order, the higher the minimum number of speakers are recommended for periphonic decode

Enhancements to Ambisonics

- Because the Furse-Malham Set of equations only encodes the direction of sound, adding further processing to help determine the distance of the sound as well can further enhance the spatialisation by generating a sonic environment.
- These enhancements are modifications of the synthesized signal, not a property of recorded Ambisonics

Common Distance Clues

- Attenuation
- Filtering
- Local Reverb (in periphonic distribution)
- Global Reverb (in periphonic distribution)
- Early Reflections (in periphonic distribution)

Composing Strategies for Ambisonics

- Constant Position
- Changing Position

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- Distribution of continuous sound events
- Distribution of discrete sound events

Entering Data of Position for Csound

- Positional data static within instrument code
- Positional data given per note through pfields
- Positional data for instrument read from external signal generated by separate instrument
- Positional data for instrument read from score generated by separate program

Limitations of Using Csound Alone

- Entering note and positional data via text may be onerous to the detriment of the compositional experience. Controlling an unlimited number of sonic events is totally impossible that way.
- Text-alone may not optimally represent visually information about the musical material, requiring extra mental tracking of the overall piece when composing

Using blue and Csound

- Offers timeline to organize musical ideas in time
- Various Score SoundObjects allow different ways to enter in musical data (PianoRoll, Python Scripting, Jmask, etc.)
- blue Instruments allow for using widgets configure instrument parameters
- Widgets are automatable and adjustable in real-time
- And more!

Examples using blue and Csound

- Spatialisation of a continuous sound source
- Spatialisation of discontinuous sound events (spatial granular synthesis)
- Spatialisation in real time

Conclusion

- Comprehensive spatialisation leads to rather complex environments, which demand a convenient way to enter the data to control it
- Various ways can be chosen to enter the data (parameters) for spatialisation
- The appropriate method has to be chosen to gain the desired result: Each method offers different opportunities